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PETROLOGICAL ABSTRACTS AND REVIEWS

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OSANN, A. "Petrochemische Untersuchungen. Th. I," *Abh. Heidelberger Akad. Wiss., Math.-naturw. Kl.*, 1913. 4to, 163, pls. 8.

In this volume the author attempts to answer two important questions in chemical petrography. First, what are the laws of the chemical composition of igneous rocks, and what are the characteristics separating the rocks of the alkali series from those of the alkali-lime? Second, what are the most important chemical differences between sediments and igneous rocks, and how may these be made of value in determining the origin of crystalline rocks?

To answer these questions, use is made of nearly thirteen hundred chemical analyses. The relationships between the oxides which vary most in their proportions in sediments and igneous rocks and which are also of value in comparing the igneous rocks, have been determined. Molecular proportions are used and recomputed to a constant sum so that they may be diagrammatically compared. Unimportant and accessory constituents are omitted, but TiO_2 and ZrO_2 are added to SiO_2 , BaO and SrO to CaO , and MnO to iron, which is calculated as FeO . The four relationships computed are:

1. $\text{SiO}_2:\text{Al}_2\text{O}_3:(\text{Fe, Mg, Ca})\text{O}=\text{SAIF}$ proportions. In this series the alkalies are entirely omitted. In sedimentary rocks this relationship leads to a grouping in three classes; siliceous, aluminous, and calcareous.

2. $\text{Al}_2\text{O}_3:\text{CaO}:(\text{Na,K})_2\text{O}=\text{AlAlk}$ proportions. This shows the more important differences between sediments and igneous rocks, and, in combination with the preceding, the characteristic differences between the alkali and alkali-lime series.

3. $\text{Na}_2\text{O}:\text{K}_2\text{O}=\text{NK}$ proportions. Recalculated to 10.

4. $\text{MgO}:\text{CaO}=\text{MC}$ proportions. Recalculated to 10.

The last two are of importance in separating igneous rocks from sediments.

The first two may be represented graphically in a triangular diagram after recalculation to 30. The results are plotted to the nearest 0.5. A

recalculation to 100 and representation to the nearest whole number seems simpler to the reviewer, especially if the calculation is performed on a slide-rule.

Pp. 68 to 161 are devoted to nearly 1,300 analyses recomputed to these four values; the chemical values used are taken from Osann's former tables and are referred to by number. In Table I the rocks are arranged according to the decreasing S, increasing Al, and decreasing F values; in Table II according to the AICalk values. Table III is arranged under the ordinary rock-names, the SAIF, etc. values being given as well as references to the literature.

Of all the analyses computed, only two coincided in all four relationships, namely, the quartz-monzonite from Elkhorn, Montana, and an average of four analyses of the Butte "granite." Since the two rocks are from the same batholith, the similarity is not surprising.

To follow the discussions of the various relationships, it is necessary to look at the accompanying diagrams. No attempt, therefore, will be made to summarize them here, and the reader is referred to the original paper.

While the present work deals only with the igneous rocks, a number of examples of sedimentaries and crystalline schists are given for comparison. A second part, dealing with sediments and schists is to follow.

This work represents an enormous amount of patient labor. It should be of extremely great value for the visualization of chemical differences in rocks.

OSANN, A. "Über topische Gesteinsparameter," *Sitzb. Heidelberger Akad. Wiss. Math.-naturw. Kl.*, 1914, A 26, pp. 15, pls. 3, fig. 1.

Rocks of a petrographic province, or from a rock-mass showing zonal or other differentiation, or from any igneous body and its satellites, when plotted in a triangular diagram after Osann's well-known system, show clearly their mutual relationships. If it is desired to show the general relationships of any igneous to the average igneous rock, it is only necessary to indicate the latter by a point properly placed. In this paper the mean of Clarke's and Washington's average rocks is taken and is recalculated in the Osann system. This gives a rock not far from the pyroxene-amphibole-biotite-diorite from Electric Peak. The latter, however, has more dioritic characters, the former more monzonitic. To show more clearly the variations of other rocks from this mean, it is shifted to the center of the triangle and the co-ordinates

of the other rocks are recalculated by dividing their A , C , and F values by the same values in the average rock. The new values are indicated by A_t , C_t , and F_t , and are called "topical" parameters. As recalculated, the plutonic rocks lie equally distributed in each quadrant of the figure.

OSANN, A., and UMHAUER, O. "Über einen Osannithornblendit, ein feldspathfreies Endglied der Alkalireihe von Alter Pedroso," *Sitzb. Heidelberger Akad. Wiss., Math.-naturw. Kl.*, 1914, A 16, pp. 10, pls. 2, bibliography, analyses.

Description of narrow, black dikes occurring in a light-colored alkali-syenite in Portugal. The rock consists entirely of amphibole (osannite) with a little magnetite; light-colored constituents, biotite, and pyroxene are entirely wanting.

PALMER, HAROLD S. "Geological Notes on the Andes of Northwestern Argentina," *Amer. Jour. Sci.*, XXXVIII (1914), 309-30, figs. 9.

This paper gives the results of a reconnaissance trip from Salta, Argentina, to Calama, Chile. The author finds evidence of the deposition of Paleozoic sediments, their later metamorphism during or following the intrusion of granite and granite-porphyry, subsequent erosion, deposition of Jurassic sediments, a period of vertical movements which folded and faulted the rocks, and a period of great volcanic activity, beginning in the Tertiary and continuing till recent times, during which rhyolites and andesites were erupted. There is evidence of some glaciation in the Eastern Cordillera.

PIRSSON, L. V. "The Microscopical Characters of Volcanic Tuffs—A Study for Students," *Amer. Jour. Sci.*, XL (1915), 191-211, figs. 6.

The author points out the difficulty in determining the tuffs when they have become altered by weathering, by burial under later sediments, or by metamorphism, and the difficulty in determining whether such rocks are igneous or sedimentary. No systematic or adequate treatment of the tuffs being given in petrographic textbooks, he tells his own experience in studying them.

Fragmental volcanic material is classified, according to the size of the material, into bombs, lapilli, ashes, and dust. The coarser material

when consolidated produces breccias, the lighter ashes and dust, tuff. The term volcanic conglomerate should be restricted to water-laid conglomerates consisting of volcanic material; volcanic agglomerate to the coarse material filling the upper portions of old volcanic conduits. Volcanic tuffs may consist of glass (vitric tuffs), crystals (crystal tuffs), or fragments of rocks which may be holocrystalline or partly glassy (lithic tuffs).

Under the head "Vitric Tuffs" the formation of tuffs, the forms of the particles, the appearance of a thin section of consolidated tuff, the shapes of the individual dust particles, the texture of the rock and the magmatic relations of the material are considered, while under "Crystal Tuffs" the origin of the crystals, their form, and the interstitial fillings, and under "Lithic Tuffs" the origin, appearance, and character are described. Although these type tuffs may occur, it is more common to find transition rocks. The author concludes his paper with a discussion of the alteration of tuffs, including their weathering and consolidation, devitrification, and metamorphism.

PIRSSON, L. V. "Geology of the Bermuda Island," *Amer. Jour. Sci.*, XXXVIII (1914), 189-206, 331-44, figs. 2, analysis 1.

This is a geologic and petrographic study of material obtained from a bore hole, 1,413 feet deep, in Bermuda. Roughly, the section, beginning at the top, shows chalky Bermuda limestone to 380 feet, sea-level being 135 feet below the surface. Between 380 and 590 feet the hole passed through fragmental volcanic material, greatly altered, soft and claylike with harder inclusions. From 590 to 695 feet the material is sand and gravel composed of water-worn volcanic débris. Beginning at 695 feet there is a series of lava flows, basaltic in character, dense and black to gray, and amygdaloidal at the tops. The separating lines between the flows are at 695, 850, 1,002, 1,080, 1,200, 1,385, and 1,413 feet, the latter the bottom of the well.

From the character of the material overlying the solid lava, the conclusion is drawn that Bermuda was once a volcanic island which was entirely cut away to the level of the sea by wave-action, and subsequently formed the platform for the growth of a coral island.

A petrographic study of the material collected from the well was made difficult by the fact that a churn-drill was used, consequently the material was in a finely divided state. The lava consists of two kinds, both belonging to the alkali series: (a) feldspar-free basalts, including

melilite-basalt, and (b) extrusives related to monchiquites and lamprophyres. For one of the latter, consisting of small biotites in a cement of analcite, which in sections from farther down is apparently nephelite, the name *bermudite* is suggested.

POWERS, SIDNEY, and LANE, ALFRED C. "Magmatic Differentiation in Effusive Rocks," *Bull. Amer. Inst. Min. Eng.*, 1916, 535-48, figs. 4.

From a series of drill cores taken from the Triassic basalt flows of Cape d'Or, Nova Scotia, the authors have had thin sections and chemical analyses made from material taken at different depths. They found that there is a concentration of the leucocratic, feldspathic constituents at the top of the flow, a slightly greater percentage of augite in the center, and of feldspar near the base. Further, there is a large amount of glass at both top and bottom, but more at the top, a rather uniform quantity of iron ores throughout, and a certain amount of olivine only at the top. The top and bottom of the flow were quickly chilled, and contain almost equal amounts of feldspar and augite. They probably show the original composition of the magma. With respect to the grain, it was found to differ in various places in thick flows. It is coarsest just below the center where the cooling was slowest, and more or less glassy at top and bottom. The specific gravity was found to be greatest just below the center, least at the top, and of intermediate value at the base.

POWERS, SIDNEY. "The Geology of a Portion of Shelburne Co., Southwestern Nova Scotia," *Trans. Nova Scotian Inst. Sci.*, XIII (1915), 289-307, figs. 3.

Granites, quartz-diorites, and aplitic granites, intruded into sediments during Middle Devonian diastrophism, produced extensive contact-metamorphism, staurolite-schist being developed ten miles from the nearest granite outcrop. Two analyses, computed from the rock mode, are given.

QUENSEL, P. D. "Geologisch-petrographische Studien in der patagonischen Cordillera," *Bull. Geol. Inst. Upsala*, XI (1911), 1-114, figs. 27, pls. 4, map 1, bibliography, analyses.

This paper gives the results of a remarkable reconnaissance journey taken along the Patagonian Andes from north to south by Doctors

Skottsberg, Halle, and Quensel, and constitutes the inaugural dissertation of the latter at the University of Upsala. No attempt was made to map the formations in detail, it being thought more desirable to cover a greater area with less accuracy. A great number of rocks are described, both alkali and alkali-lime, and numerous analyses are given. Among the rocks are biotite-monzonite, quartz-monzonite, kentallenite, nordmarkite, quartz-mica-diorite, tonalite, tonalite-porphyry, biotite-granite, bronzite-orthoclase-gabbro, granite-porphyry, quartz-hypersthene-diorite, essexite, essexite-gabbro, quartz-essexite-diabase, comendite-granophyre, hornblende-akerite, essexite-porphyrite, camptonite, trachydolerite, and hypersthene-andesite.

QUENSEL, P. D. "Die Quarzporphyr- und Porphyroidformation in Südpatagonien und Feuerland," *Bull. Inst. Upsala*, XII (1913), 9-40, figs. 12, analyses.

QUENSEL, P. D. "The Alkaline Rocks of Almunge," *Bull. Geol. Inst. Upsala*, XII (1914), 129-200, pls. 12, map 1, analyses.

The alkaline rocks of Almunge represent a deep-seated section of the conduit through which magma flowed for some time, as indicated by contact metamorphism of the surrounding rocks. The central mass of umptekite is surrounded by a rim of aplitic material. Within the main body, mostly in the eastern portion, are small areas of nephelite-syenite containing a high percentage (7 to 8 per cent) of lime. This lime does not enter into the feldspar, which is orthoclase and very sodic plagioclase, but is contained in the dark minerals. For this rock the author proposes the name *canadite*.

RANKIN, G. A. "The Ternary System $\text{CaO}-\text{Al}_2\text{O}_3-\text{SiO}_2$," *Amer. Jour. Sci.*, XXXIX (1915), 1-79, figs. 19. With optical study by Fred. E. Wright.

While numerous papers on the $\text{CaO}-\text{Al}_2\text{O}_3-\text{SiO}_2$ system have been published, all of them have been incomplete. This paper contains a summary of work performed, and is the first attempt to determine all of the compounds, both binary and ternary, in this system. The equilibrium diagram representing the stability relations contains 14 fields. A list of the compounds obtained, with their crystal system, crystal habits,

cleavage, hardness, elongations, orientations, refractive indices, optical characters, and axial angles is given. There are also lists giving the compositions, transformation-points, and melting-points.

RICHARDS, H. C. "The Volcanic Rocks of South-Eastern Queensland," *Proc. Roy. Soc. Queensland*, XXVII (1916), 105-204, pls. 11, including one map, and many chemical analyses.

The area here described embraces some 4,000 square miles in south-eastern Queensland. The region was one of considerable igneous activity, the volcanic products being approximately 3,000 feet in thickness and divisible into three well-marked series. The upper division has a maximum thickness of 2,000 feet and is made up of basalt, andesitic basalt, and basalt flows. Some pyroclastic material occurs. The middle division has a maximum thickness of 1,000 feet and is made up of flows and plugs of acid and sub-acid lavas and considerable pyroclastic material. The lower division has a maximum thickness of 1,500 feet, though it averages only 100 feet, and is made up mainly of basic lavas with some andesite. With the exception of the Brisbane tuffs, the age of the flows is Cainozoic. The genetic relationship between the rocks is shown by various diagrams. The author thinks that the alkaline rocks in this region were not formed by the assimilation of limestone, and does not find evidence of the association of sub-alkaline rocks with folded earth movements.

RINNE, F. "Beiträge zur Kenntnis der Kristall-Röntgenogramme," *Ber. math.-phys. Kl. k. sächs. Gesell. Wiss. Leipzig*, LXVII (1915), 303-40, figs. 27, pls. 20.

Describes apparatus used and gives results obtained by the examination by the Röntgen rays of variously oriented crystals.

RINNE, F. "Metamorphosen von Salzen und Silikatgesteinen," *Jahresb. d. Niedersächs. geol. Vereins z. Hannover*, 1914, 252-69.

Shows the effects of hydro-, hydrothermal-, pressure-, and hydrothermal-pressure-metamorphism on salt deposits, and compares the results with those produced in silicate rocks. The causes and the results produced in the salt alterations are broadly the same as those produced in the silicate rocks.

RINNE, F. "Beitrag zur optischen Kenntniss der kolloidalen Kieselsäure," *Neues Jahrb. Min., Geol., u. Pal.*, B.B. XXXIX (1914), 388-414, figs. 12.

Describes apparatus and results obtained by the examination at different temperatures, between -600° and $+1000^{\circ}$, and by light of different wave lengths, of various amorphous silicates, such as quartz-glass, hyalite, precious opal, moldavite, obsidian, and marekanite. It was found that these substances fell into two groups, water-free or water-poor, and water-rich. In the former the refractive indices progressively increased with temperature changes, while in the latter they increased to the neighborhood of 0° and then decreased.

RINNE, F. "Die Kristallwinkelveränderung verwandter Stoffe beim Wechsel der Temperatur. I," *Centralbl. Min., Geol., u. Pal.*, 1914, 705-18, figs. 9.

With the apparatus described in the preceding paper, the author found that the angle of the rhombohedron (1011) in calcite, dolomite, siderite, and rhodochrosite increased with increasing temperature. Above 0° the curve is a straight line, below 0° it is slightly curved. The plagioclase feldspars show a decrease in the angle 001-010 with increasing temperature. Albite shows the greatest change, anorthite the least. The curves are very flat at low temperatures and rapidly drop at high temperatures.

SCHMIDT, EDUARD. "Die Winkel der kristallographischen Achsen der Plagioklase," *Chemie der Erde*, I (1915), 351-406, figs. 13, bibliography.

A study of the plagioclase feldspars, unusually valuable since the material was analyzed. There are new determinations of the cleavage angle (001):(010), which show that this angle is a linear function of the An. content. The specific gravity determinations, with one exception, agree very well with the determinations made by Day and Allen on artificial feldspars. The value for the labradorite from Labrador is given as 2.689 ± 0.003 , and its composition as An. between 49 and 50; the artificial feldspar $Ab_{17}An_{83}$ gives a value, according to Day and Allen, of 2.679. The material from Labrador, however, was zonal, and the An. percentage as computed from the silica, lime, alkalis, etc., varied between 44.8 and 55.8. It is possible, therefore, that the anorthite

percentage should have been taken higher. There are also new values for the angles between crystallographic a and c (β) and between a and b (γ). Query: Is not the anorthite cited as from the Bonin Islands, Japan, from Miyaké-jima instead?

SCHOFIELD, S. J. "The Origin of Granite (Micropegmatite) in the Purcell Sills," *Canada, Dept. Mines, Museum Bull., No. 2, Geol. Series, No. 13*, 1914, pp. 32, figs. 4, pl. 1.

The Purcell sills represent, according to the author, intrusions from a single intercrustal reservoir, which he apparently believes contained the magma already differentiated according to density, the relatively acid portion collected in irregularities and projections of the roof of the chamber and grading downward into more basic materials. Crustal movements produced fissures which tapped the reservoir at various levels, so that acid and basic materials would rise through separate fissures and spread between the overlying strata as sills. The sills themselves are simple or composite. The former solidified in the usual manner of intrusives; the composite sills differentiated in place, some of them having basic upper and lower contacts and an inner portion which is more acid in the upper part and more basic in the lower. The composition of the sills may be slightly modified by assimilated material derived from included fragments or from the inclosing rock.

SCHOFIELD, S. J. "The Pre-Cambrian (Beltian) Rocks of South-eastern British Columbia and Their Correlation," *Canada, Dept. Mines, Museum Bull., No. 2, Geol. Series, No. 16*, 1914, pp. 13, map 1.

SCHWARZ, E. H. L. "The Granite Dykes of the 3,520 Foot Level, Kimberley Mine," *Trans. Geol. Soc. S. Africa*, XVII (1914), 3-23, fig. 1, pls. 4.

SEDERHOLM, J. J. "On Regional Granitization (or Anatexis)," *Congrès géol. intern., Canada*, 1913. Pp. 6.

A study of migmatites and the processes by which granites work their way into adjacent rocks.

SHAND, S. J. "On Veins and Inclusions in the Stellenbosch Granite," *South African Jour. Sci.*, 1913, pp. 5, pls. 3.

Describes various types of veins and inclusions in granite.

SHAND, S. J. "On Saturated and Unsaturated Igneous Rocks," *Geol. Mag.*, X (1913), 508-14.

Saturated, or sated, minerals are those which are capable of forming in the presence of free silica; unsaturated, or unsated, are those which do not appear in association with free silica. Among the former are orthoclase, albite, anorthite, pyroxenes, amphiboles, micas, tourmaline, spessartite, topaz, titanite, magnetite, ilmenite, apatite, zircon; among the latter, leucite, nephelinite, sodalite, noselite, analcite, cancrinite, hauynite, melanite, melilite, olivine, pyrope, picotite, corundum, and perovskite.

SKEATS, ERNEST W. "The Occurrence of Nepheline in Phonolite Dykes at Omeo," *Australasian Assoc. Adv. Sci.*, XIII (1912), 126-30, map 1.

Previously reported occurrences of feldspathoids in Victoria are shown to be undemonstrated or inaccurate. Here are described several phonolite dikes from near Omeo. The texture is trachytic, the minerals soda orthoclase, nephelinite, and aegirite.

SKEATS, ERNEST W. "The Geology and Petrology of the Macedon District," *Bull. Geol. Surv. Victoria*, No. 24. Melbourne, 1912. Pp. 58, pls. 28, map 1, analyses.

This paper gives a short geologic history of the Macedon District, 40 miles northwest of Melbourne. The principal part of the paper, however, is devoted to the petrology of the region. The rocks described are dacites, granodiorites, granodiorite-porphyrries, solvsbergites, trachytes, limburgites, anorthoclase-basalts, basalts, various metamorphic rocks, and two rocks described as macedonite and woodenite. Both are related to orthoclase-basalts and mugearites. The *macedonite* is dense and fine-grained with megascopically visible biotite flakes. The minerals shown microscopically are alkali feldspar, anorthoclase(?), acid plagioclase, biorite, olivine, hornblende, augite, apatite, calcite, chlorite, serpentine, and chrome spinel. The *woodenite* is a dark, dense rock consisting of augite, magnetite, and olivine in a groundmass of dark glass. It agrees closely in chemical composition with absarokite. Twenty-nine analyses are given of the various rocks, and they are recomputed in the C.I.P.W. system. The sequence of the alkali rocks in this district is discussed.

SOBRAL, JOSÉ M. *Contributions to the Geology of the Nordingrå Region.* Upsala, 1913. Pp. 178, pls. 12, map 1, fig. 1, many analyses.

The rocks of the Nordingrå district belong to three different geologic epochs. The oldest is composed entirely of igneous rocks—anorthosites, gabbros, and granites—and is of most importance. The second group consists of Jotnian quartzite and sandstone; the third of more recent diabases and monzonites intruding and covering the sandstone. The topography of the region is due in part to faults, some of the firths and valleys certainly having been caused by dislocations, but the consolidation of the magma and the composition of the igneous rocks have had the greatest effect upon the land forms.

Analyses are recalculated into the C.I.P.W. and Osann systems.

A new dike-rock, consisting essentially of albite and augite with titanite, magnetite, and apatite, is described and analyzed. The author calls it *värnsingite*. An analysis is given.

SOMERS, RANSOM EVARTS. "Geology of the Burro Mountains Copper District, New Mexico," *Bull. 101, Amer. Inst. Min. Eng.*, 1915, 957-96, figs. 25.

This paper deals chiefly with the economic geology of the region, although a few pages are devoted to the general geology and the igneous rocks which occur. Among the latter are granite, quartz-porphyry, quartz-monzonite, and volcanic breccias.

SOMMER, MARTIN. "Beitrag sur petrochemischen Kenntniss des Lausitzer Granitmassivs," *Ber. k. sächs. Gesell. Wiss.*, 1915. Pp. 71, pls. 4, including one map.

The Lausitz granite area to the east of Dresden consists of twelve varieties of granite; a normal granitite, a normal granite, and ten other varieties. All but one of these varieties were analyzed, and these, as well as a number of older analyses, are given. The molecular percentages are computed and the results plotted in Osann's ACF, SAIF, and AICalk diagrams and in FeCaM, CaNaK, and M_2O_3 MO M_2O triangles. All of these clearly show the relationships between the various granites, for the points lie practically along straight lines, or within small circles. The relationships between the different rocks are discussed.